Resource Action: EWG-1	**Task Force Recommendation Category: 3**

SEGREGATING SPRING-RUN CHINOOK SALMON BY PROVIDING PASSAGE TO THE FISH BARRIER POOL

Date of Field Evaluation: No field evaluation was conducted

Evaluation Team: Philip Unger

Description of Potential Resource Action Measure:
The existing Feather River Hatchery (FRH) fish ladder would be modified and a new structure would be constructed to segregate the spring and fall-runs of Chinook salmon in the FRH. The existing ladder would be modified by adding a side branch to allow fish passage from the FRH ladder upstream to the Fish Barrier Pool. A new structure would need to be constructed to provide passage from the Fish Barrier Pool to the FRH. This structure would be either a fish ladder or a fish channel, depending on the relative elevations of the FRH and the Fish Barrier Pool. The ladder leading from the river to the Fish Barrier Pool would be opened during spring, when upstream migrating adult spring-run begin arriving below the Fish Barrier Dam, and would be closed when sufficient number of spring-run had entered the pool to meet FRH production goals. The ladder would remain closed when the fall-run salmon arrived, thus preventing these fish from accessing the Fish Barrier Pool. The spring-run salmon would be allowed to hold in the Fish Barrier Pool until autumn. When the holding fish were ready to spawn, the ladder or channel from the Fish Barrier Pool to the FRH would be opened and the spring-run would be spawned in the hatchery.

Related Resource Actions:
- EWG-2A, EWG-2B, EWG-34, and EWG-41, which are related to this measure, as they also address the resource goal of segregating the spring and fall Chinook salmon runs.
- EWG-97A and EWG-97B, which provide for transport or passage of spring-run Chinook salmon to the Feather River tributaries upstream of the project facilities, are also related to this action.

Nexus to the Project:
This resource action is related to ongoing project operations and facility structures that impede or restrict passage of anadromous and migratory fish to historic spawning habitat in the Feather River above the Oroville Facilities. The Feather River downstream of the Fish Barrier Dam does not permit the spatial segregation of spring and fall-run Chinook salmon spawning. The FRH, which is intended to mitigate for loss of upstream habitat, also has been unable to successfully segregate the spring and fall runs.

Potential Environmental Benefits:
Although the spring and fall-runs of Chinook salmon migrate upstream to the Feather River at different times of year, they spawn at about the same time. Immature spring-run adults begin arriving in the Low Flow Channel (LFC) of the Feather River as early as March and hold in deep pools through the spring and summer before they are ready to spawn. In contrast, the fall-run enter the LFC starting about September and begin spawning shortly after they arrive. Intense competition for limited spawning habitat, superimposition of redds, and introgression between the runs are thought to be serious problems in the Feather River system. Also, because the spring-run cannot be held over the summer in the FRH, the hatchery has been unable to successfully segregate the two runs. Segregation of spring and fall-run salmon is of particular interest among members of the FERC collaborative. Providing passage to the Fish Barrier Pool for the early arriving spring-run salmon, and eliminating such passage for the fall-run fish, would provide a means for segregating the runs for FRH production. The spring-run would be allowed to hold over the summer in the pool and the ladder or channel from the pool to the FRH would be opened when the fish were ready to spawn in the fall. By spatially separating part of the LFC's spring-run salmon spawning from the fall-run spawning, this action would potentially result in greater genetic integrity and higher production of a spring-run population.

Potential Constraints:
The principal potential constraints on this measure are; 1) the costs of constructing the new fish ladder or fish channel structures and 2) potentially reducing the number of naturally spawned spring-run Chinook produced in the LFC. A potential design constraint may arise from the relative elevations of the FRH and the Fish Barrier Pool. If the FRH is not elevated above the Fish Barrier Pool sufficiently to provide adequate attraction flow for salmon in a fish channel, water would have to be pumped through the channel to provide the flow. The Fish Barrier Pool is in the high flow flood zone of the Feather River, and high spring flows would potentially harm spring-run salmon in the pool. A number of permits would be required in order to install and operate the fish ladder extension, including: Army Corps of Engineers, Nationwide Permit; NOAA Fisheries, Endangered Species Take Authorization; DFG, CEQA; and USFWS, NEPA.

Existing Conditions in the Proposed Resource Action Implementation Area:
The Fish Barrier Dam and Pool lie between the Thermalito Diversion Dam and the LFC of the Feather River. The pool has a storage capacity of 560 acre-feet (AF) and a surface area of about 50 acres. Except during flood conditions, the Fish Barrier Pool receives a relatively constant discharge of about 600 cubic feet per second (cfs). No fish sampling has been conducted in the Fish Barrier Pool, but the fish assemblage is believed to be similar to that of the Thermalito Diversion Pool, which is dominated by cold-water species, including rainbow trout, brook trout, brown trout, and Chinook salmon. These species are or have been stocked in the Thermalito Forebay, from which fish can freely swim to the Thermalito Diversion Pool. The Fish Barrier Dam diverts upstream migrating salmon in the Feather River into the ½-mile long FRH fish ladder. Gates to the fish ladder, which are located at the base of the dam, are generally

open from about September through the end of March. Currently, salmon entering the fish ladder in September are considered spring-run Chinook salmon and those entering after October 1 are considered fall-run salmon. Four concrete tanks at the head of the fish ladder collect and hold the adults until they are ready to spawn. The Feather River downstream of the Fish Barrier Dam provides approximately 16 river miles of spawning habitat for wild and hatchery origin spring and fall-run Chinook salmon and steelhead. Under current conditions, substantial conflicts exist between these fishes, particularly in the LFC where the vast majority of salmon spawning activity takes place. The habitat available for spawning does not permit the spatial segregation of in-river spawning spring and fall-run Chinook salmon. Lack of segregation, combined with large numbers of fish, results in substantial superimposition of salmon redds and permits introgression between spring and fall-run salmon. As noted previously, the FRH, which is intended to mitigate for loss of upstream habitat, has been unable to successfully segregate the two runs because the adult spring-run cannot be held over the summer in the hatchery holding tanks. The failure of spring and fall-run segregation is evidenced by the apparent lack of genetic distinction between these two Chinook races.

Design Considerations and Evaluation:
The fish ladder extension would need to be designed to withstand flood flows. Operations in the spring and early summer would need to be modified to divert suitable flow from the Fish Barrier Pool into the downstream fish ladder extension. In the fall, the FRH would have to release and/or pump sufficient flow into the ladder or channel to the Fish Barrier Pool. Habitat improvements would potentially be required in the Fish Barrier Pool to meet habitat requirements for holding spring-run Chinook salmon (as determined using information from SP-F10, Task 1E).

Synergisms and Conflicts:
This resource action is compatible with the resource goals described in EWG-2A, EWG-2B, EWG-34 and EWG-41, which relate to segregation of spring and fall run Chinook salmon. This resource goal might also be viewed as an alternative to EWG-97B and EWG-98, which seek to provide segregation (and natural production) of spring-run salmon by creating passage opportunities or providing transport to new habitats.

The most important potential conflict from this measure is a potential reduction in the number of naturally spawned spring-run Chinook produced in the LFC. Production of wild-origin spring-run Chinook salmon is an important resource goal of many members of the FERC collaborative. If some of the adult spring-run salmon were removed from the Feather River for FRH production, numbers remaining in the river to spawn would be reduced. It is not certain that such a reduction would affect LFC production of spring-run, but it is a possibility.

Uncertainties:
A major uncertainty with this measure is the effectiveness of the modified fish ladder in passing spring-run Chinook salmon to the Fish Barrier Pool and of the effectiveness of the new fish ladder or channel in passing the salmon from the Fish Barrier Pool to the

FRH. Other important uncertainties include the adequacy of the Fish Barrier Pool as holding habitat for the salmon, and how genetically similar the early arriving Chinook salmon currently found in the Feather are to the pre Oroville spring-run stock of the river. Also uncertain, as noted above, is the effect on wild spring-run Chinook salmon production of removing adult spring-run salmon from the LFC.

Cost Estimate:
Although a specific design and implementation cost estimate for this measure has not yet beet determined, the costs for this Resource Action would be much greater than those for EWG-2A, which would accomplish similar goals of segregating spring and fall-run Chinook salmon.

Recommendations:
This resource action would likely result in production of more genetically distinct spring-run Chinook salmon in the Feather River. However, these would be hatchery-origin fish and the action has the potential to reduce production of wild origin spring-run Chinook salmon. The EWG-2A resource action provides a more cost-effective means of segregating spring and fall-run Chinook salmon that would also potentially increase production of wild fish of both races. If this resource action were to be adopted, it should be adopted to supplement EWG-2A by providing increased holding habitat for hatchery produced spring-run salmon.